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ABSTRACT

For the field of human development, the synthesis of older theories of the environment, newer context theories, biological theories, and systems theories permit the generation of new models for the developmental process. This paper reviews, compares, and contrasts recent theories of development and presents a synthesis that can guide future research and practice. The paper describes development from a systems perspective (environmental, ecological, and biological factors that affect development), and in terms of control and operating systems, and then as a series of overlapping programs. Finally, the paper presents a general model for prediction of developmental status, considers its similarities and differences to other models, and the model's advantages and disadvantages. Contains 75 references. (TM)

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Theory Development in Human Development: A Synthesis for 2000 and Beyond

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Theory Development in Human Development:
A Synthesis for 2000 and Beyond

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BACKGROUND

The theme of the 1994 AERA of "Alternative Learning Environments" points to the importance of considering the larger context in predicting and managing behavior. One of the most exciting new areas to emerge in the study of human development is the synthesis of older theories of the environment, newer context theories, a range of biological theories, and systems theory. These amalgamations have produced theories of development that are quite robust, and, further, permit the generation of new models of the developmental process.

The purposes of this paper are to (a) review, compare, and contrast recent theories of development, and (b) to present a synthesis that can guide research and practice in the year 2000 and beyond.

In the 1970s and early 1980s several frameworks were put forward to begin understanding development within a systems perspective. Riegel (1976) proposed a dialectic model. Urban (1978) outlined a broad systems view based on systems principles from other disciplines. Work begun earlier in the area of life-span development fueled these conceptualizations (Buhler, 1968; Havighurst, 1972; Baltes, Reese, & Lipsitt, 1980). Scarr and

McCartney (1983) proposed a theory of genotype-->environment relations. Horowitz (1987) presented an empirically based model of development combining structural and behavioral traditions. Lerner and Kauffman (1985) argued for a contextualized view of development.

In the last half of the 1980s formulations began to appear that had the character of true systems perspectives. Oyama (1985) and Thelen (1987) argued that the actual form of development is constructed across time, i.e., developmental status at time 2 is driven by developmental status at time 1. Ford and Lerner (1992) presented an integrative approach to developmental systems theory. Scott (1987) synthesized genetic and ecological factors into an heuristic predictive formula.

A number of environmental factors that affect development have now been studied extensively. The culture in which a child or family is embedded serves not only as the larger context for development but also produces the specific environmental factors that guide day to day development. Older notions of culture as a global undifferentiated system have given way to newer, more specific formulations (Levine, 1984; D'Andrade, 1984). Diversity among cultural groups influences such basic processes as personality (Holtzman, 1982), language (Ochs & Schieffelin, 1984), cognition (Stevenson, 1982), and moral development (Shweder, Mahapatra, & Miller, (1990). In fact, it has been argued that overall competence is best defined within a cultural context (Gardner, 1984; Ogbu, 1981, 1990).

Models of other ecological factors that contribute to the developmental system have also been growing apace. Bronfenbrenner (1979) has proposed a four level model of the developmental environment. Barker (1968) and Schoggen (1989) developed a theory of behavior settings to show how the environment is ordered to influence development. McCall (1983) suggested that approximately 25% of the influence on development comes from nonshared family factors. Cochran and Brassard (1979) discussed the social network that shapes development. Ogbu (1981) and Scott (1987, in press) have argued that the environment stimulates (or mandates) naturally occurring adaptative behaviors. One of the more interesting empirical studies to confirm a more complex systems view of development is the longitudinal study of Werner (1989) showing that constitutional factors, e.g., temperament, interweave with environmental factors, e.g., continuing strong support of an adult, to produce resiliency in children.

Recent research on the contribution of biological factors as they interact with culture and environment has also contributed to a more complex understanding of development. Knowledge of the links between gene action and behavioral development has expanded from the earlier notion that only physical traits result from genes to studies that show the relationship between kinship and cognitive or intellective patterns (Scarr & Kidd, 1983). Further, behavioral patterns that were once thought to be exclusively under the control of environmental events have now

also been shown to be linked to genetics. Goldsmith (1983) summarized research showing that four personality traits, sociability, emotionality, activity, and some fears, had at least some genetic component. Chess, Thomas, & Birch's (1968) studies suggested a biologically based difference in temperament among some children. Schizophrenia shows a higher concordance among related than nonrelated persons (Gottsman & Shields, 1973)

Newer models of development have begun to reveal the complex dance among a variety of factors that actually creates development. For example, it has been known for some time (Penfield, 1964; Rosenzweig & Bennett, 1978; Cowan, 1979; Shatz, 1992) that experience sculpts the brain, i.e., some basic components of the structure and function of the neuronal network are actually created based on experiences. Barbara McClintock was awarded the Nobel Prize in 1983 for her work on genetic transposition (the "jumping gene phenomenon") showing that genetic material moves from one place on the DNA to another based at least in part on factors in the environment. These studies suggest that the older view that genetics and biology are not related, or only minimally so, to behavior and intervention is no longer tenable. Knowledge about a child's biological factors can, in fact, increase the precision of any environmental treatment planned for her or him.

A HIERARCHICAL SYSTEMS MODEL OF DEVELOPMENT

Control and Operating Systems of Development

Control systems of development are those processes and mechanisms that serve an initiatory function (Gottlieb, 1983; Scott, 1979). They may originate either within the organism or within the environment. Operating systems are those processes and mechanisms that support or permit the organism to keep going. They support change but they do not cause reorganization. Operating systems may also originate either within the organism or within the environment.

These two processes are not easy to separate for several reasons. First, it is difficult to discriminate where one process ends and the other begins. Second, the same process may be a control process at one time and an operating process at another time. Third, the determination of whether a mechanism is a control process or an operating process depends to some extent on the level at which the question is being asked. For example, some processes, e.g., hormonal, are control processes for one level of development but operating processes for another level of development.

There are thought to be two control systems within the organism. These are survival and competence. Humans appear to be programmed to survive first as individuals and then as a species (Salkind, 1985). The second control system is the drive toward competence (White, 1959; Ogbu, 1981; Montessori, 1936). This control system is somewhat similar to adaptation but goes

beyond it. These control systems function much like a set of basic goals or organizing rules. They organize and guide the structures and functions (the subsystems) of the rest of the system, but they do not operate these subsystems. Once their initial directions have been carried out, their next function is to monitor the operation of the subsystems and to override the operation of the subsystems whenever subsystem moves threaten the basic programs.

The operation of these control systems is carried out by the genotype as it interacts with the environment. Scarr & McCartney (1983) believe that the genotype is conceptually prior to experience and that it "drives" experience, i.e., the genes determine, through a range of reaction (Gottsman, 1963), the environments that a given genotype will find compatible. Developmental status at any given point also acts as a control mechanism for developmental status at subsequent points (Penfield, 1964). Most developmental theorists have agreed that early "prototypes" foreshadow later development (Salkind, 1985). Other examples of control systems of development are nutrition (Zamenhof & Van Marthens, 1978) and hormones (Whitsett & Vandenbergh, 1978). Oyama (1985) argues that the genes and the environment form a nonreducible system that acts as the control system.

Control systems of the environment toward development are considerably less well understood. The major problem here is that the environment has been infrequently studied by

psychologists as the environment (Barker, 1965). This is very different from studying bits and pieces of the environment as they relate to some behavior, the number of which studies is legion and would constitute a good portion of the index of Psychological Abstracts. Some good starts have been made recently on describing and classifying the environment. Examples include Brim's (1975) classification of microenvironment, mesoenvironment, and macroenvironment and Bronfenbrenner's addition of exosystem environment (1977). A good beginning has also been made in determining whether effects of the environment on development are best viewed as global, specific, or bi-factor (Wachs, 1979; Wachs & Chan, 1986; Wachs & Gruen, 1982).

Control systems in the environment are somewhat different from those in the organism. They consist principally of organization and cycles. The environment is organized with respect to human behavior and development. This principle of organization is similar to that of Piaget (1970), i. e., organized as opposed to random. There are thought to be three types of organization, physical, social, and linked. Organization of physical features in the environment has been recognized for some time. Trees grow in the ground, desks and chairs tend to be clustered together, etc. Social features of the environment are similarly clustered, hence preschools, families, graduate seminars, tribes. The environment also controls development through cycles of events or objects. Examples of physical cycles are the seasons of the year and

weather (such as in a rainstorm). Examples of social cycles are a dinner party (arrival ceremonies, dinner, departure ceremonies) and a trial (case presented, judge instructs the jurors, they deliberate), and the development of a group (as in a peer group). Linked organizational patterns combine physical and social features of the environment, e.g, the use of eating utensils or bathroom behavior.

Environmental constructs that appear to have the initiating characteristics of control systems are behavior settings (Barker, 1968), culture (Ogbu, 1981), and, perhaps, context (Lerner & Kaufman, 1985; & Moshman, 1982). At the life-span level, history-graded events and life-course graded events (Baltes, Cornelius, & Nesselroade, 1980; Baltes & Willis, 1979) appear to have these characteristics in principle, although not enough work has yet been done in this area to determine if this is the case.

The case of behavior settings may serve to clarify the nature of control systems of the environment. A behavior setting is a specified set of time, place, and object props <u>together with</u> an attached, standing, pattern of behavior (Barker, 1968). These two clusters of identifying attributes operate at the molar level, are synomorphic, the physical features are circumjacent to the behavioral features, and the two clusters have a greater degree of interdependence among themselves than they do with features outside the setting. There is a method of identifying these settings (behavior setting survey) and a scale for determining the degree of interdependence (K-scale) (Barker &

Wright, 1955/1971). Examples of behavior settings include Mrs. Smith's third grade, Kroger's grocery store, family mealtime, the Little League game, etc. These behavior settings have been shown to direct very strong forces toward human behavior. In fact, in some cases, behavior settings are more coercive toward behavior than are individual differences (Gump & Kounin, 1960; Hatfield, 1983; Lund, 1982). All the individuals in worship service behave in similar ways despite substantial variations in, say, personality. The same individuals behave in similar ways in basketball game, again, despite varying personalities. In fact, the difference between individual A's behavior in worship and basketball is greater than the difference between A's and B's behavior in either setting. Furthermore, it has been shown that settings operate differentially upon individuals of different ages (Barker & Wright, 1955/1971) and behavior in a setting is thought to be one means of assessing developmental level (Carlson, Scott, & Eklund, 1980).

A second example of a control mechanism in the environment is culture. Culture operates at the global level (Scott, 1976). Ogbu (1981) has suggested that a drive for competence is innate and that groups of people (cultures) organize their belief systems and their activities in a feedback loop system designed to optimize success within whatever environment the culture finds itself.

Operating systems for development are those processes and mechanisms that support development but do not initiate it.

Examples of operating systems within the organism are digestion in the physical arena, assimilation and accommodation in the cognitive arena, and defense mechanisms in the affective arena. Examples of operating systems within the environment are affordances (J. Gibson, 1979; E. Gibson, 1982) and reinforcers (Bijou & Baer, 1961). These two examples point to the difficulty of differentiating clearly between control systems and operating systems, especially within the environment. While both serve to maintain development, each may also, under certain circumstances, serve to control development. This simply reinforces the point made earlier that considerably less is known about the systematic way in which the environment is organized and operates toward development than is known about the organism's role in development.

The knowledge base in human development with respect to control and operating systems is perhaps weaker than in any other area of developmental study. Although it is clear that the two processes exist, it is frequently unclear which aspects of development function as which processes. It may be more fruitful to think of development as a series of overlapping programs.

Development as a Series of Overlapping Programs

Gollin (1981) described development as being multimodal and polyphasic. A number of different aspects of development are in progress at any given point. Each of these operates within a cycle determined by its own requirements. Some cycles are short, some long, some of large import, some of small import, etc.

Examples of such programs include neuronal migration and myelination in the central nervous system, puberty, object permanence, attachment, etc. Chiszar (1981) thought that development was polymorphic and polyethic. Species may show either obligate polymorphism in which there are two or more structural forms which do not change (male and female in humans), or facultative polymorphism in which an individual may change form based on background chromaticity, social circumstances, or age-related effects. For example, at least nine orders of fish are known to contain species that undergo complete and functional sex reversals (Chiszar, 1981; Ginsburg, 1978). Species may also be polyethic, i.e., have variable behavioral forms. Chiszar (1981) believes that facultative polyethisms may predominate and include such examples as dominance status, social roles, etc.

Development may then be described as a system containing hundreds of sets of overlapping subprograms. These sets are nested. Each of the subprograms operates according to its own rules, e.g., CNS development, but it also operates within the constraints of the general system of the organism as a whole, e.g., age (maturation), and within the constraints of the environment, e.g., nutrition. The larger system sends general directions to the subprogram. It can also override the subprogram at any given point. The various subprograms or cycles then relate to each other in a variety of ways. Earlier cycles influence later ones, e.g., infant attachment patterns influence later social relationships, severe nutritional deficits influence

later brain and cognitive growth. The system as a whole at one point also influences the development of the system as a whole at a later point. Figure 1 illustrates the relationship of cycles within a system and the relationship of the system at one point to the system at another point.

Insert Figure 1 about here

A Model for Predicting Developmental Status

Given what is now known about development it may be possible to construct a general model for the prediction of developmental status. This model is presented in Figure 2. The model is intended to be heuristic rather than mathematical. It is expressed as an equation in order to increase the precision of the formulations.

Insert Figure 2 about here

Several assumptions underlie this model. first, it is assumed that a given developmental status is probabilistic rather than certain (Brunswick in Postman & Tolman, 1959; Gottlieb, 1983). Second, it is assumed that development is hierarchical and cumulative (Gottlieb, 1983); therefore, past developmental status represents a constraint on subsequent statuses. Third, it assumed that both genes and environment produce development, and in some specific ways. And finally, it is assumed that aleatory

factors play a role in the determination of development (Gergen, 1977).

By genotype function is meant the operation of the genotype as it produces the various physical, cognitive, and socio-emotional phenotypes (Scarr & Kidd, 1983). Genotype function is assumed to contain several elements. First, since genes are themselves influenced by the environment (McClintock in Keller, 1983), the genotype function at any given point in time is not the same as the original genotype. Second, each gene is assumed to operate within a range of reaction (Gottsman, 1963; Scarr-Salapatek, 1975). Third, potential for greater change is known to exist during vulnerable or sensitive periods (Scott, 1979; Cowan, 1979).

By effective environment is meant that portion of the environment that actually reaches the organism as differentiated from the nominal environment. The effective environment is also not to be confused with that portion of the environment perceived by the organism, i.e., the phenomenological environment. The effective environment is assumed to contain several elements. First, both physical and social features of the environment influence development. These may arise from any one of several of the macrosystem, mesosystem, microsystem, of exosystem levels (Brim, 1975; Bronfenbrenner, 1977). Second, developmental effects from the environment are assumed to be a function of the force with which the environment encounters the organism. For example, a strong wind versus a breeze or a great deal of

nurturance versus little. Third, the state of organization of the environment at the time of the encounter with the organism directs development. For example, a well organized family system versus a poorly organized one or rich cognitive mediation strategies from parents to child versus poor ones. Fourth, the point in the environment's cycle when it encounters the organism is assumed to influence development. For example, if a peer group encounters a child during early phases of its formation the effects are different than they are if the group is in a later phase. In general, intermediate phases of a cycle are thought to be more stable than are either earlier or later ones (e.g., riverbed formation and its influence on surrounding environments). Finally, aleatory factors are thought to play a role in the influence of the environment on development.

Time is a frequently considered factor in development. Its precise role in development is far from clear. In this model it is assumed that the passage of time is necessary in order for development to occur but no causative assumption is made. The portions of the model are summed across time in order to account for their cumulative effects.

Similarities and Differences Between the Model and Other Models of Development

The model of development presented here may be compared and contrasted with other models of development. It shares with others the idea that development is constructed over time (Oyama, 1985; Lerner & Kauffman, 1985; Featherman & Lerner, 1985). That

development is highly plastic and the result of a complex dance between individual and environmental factors is common to many current models (e.g., Gollin, 1981). The idea that development is probabilistic rather than known is shared with Gottlieb (1983), and Scarr (1985). The idea that this probability is fueled by chance is not shared with many other models with the notable exception of Gergen (1977).

The unique features of the model include the components selected and the way in which they are put together. The ideas of organization and cycles within both the individual and the environment were not located in any other model. The idea of control and operating systems was not seen in another model, although there is some similarity to Scott's (1979) developmental and maintenance processes. Finally, the specific attention paid to the environmental side of the model was not seen in other developmental models, although it is quite similar to Barker's (1968, 1987) ideas of ecobehavioral science.

Advantages and Disadvantages to the Model

There are several advantages to this model. First, it combines into one system the known major influences on development. Second, it treats the environmental side of the equation as an organized system equally dynamic to that of the organism. Third, it allows for weighting components that may have differential influence at various points.

There are also several disadvantages to the model. First, it is cast at a general level with respect to some aspects and at

a specific level with respect to others. This may be more of a criticism of the state of knowledge in the area than of the model, however. Second, the model would be difficult to test given the current state of knowledge. This would not prohibit the model from serving as an organizing framework or heuristic.

There are several criticisms that could be leveled at the model that are thought to be irrelevant. One of these is that the model does not account for every possible point in development. No model meets this test. The main purpose of model construction is not to specify truth but to move toward truth (Scott, 1987; Scarr, 1985; Cunningham, in press). A second possible but irrelevant criticism is that the model simply generates more levels of analysis. This is a continuing characteristic of most sciences and not an attribute of this model alone.

Summary

The last half-decade has seen some exciting new theoretical developments in human development. This paper attempted to synthesize some of those and present a model for the prediction of developmental status. Control and operating systems for development were discussed. Development was described as a series of overlapping programs. Finally, the prediction model was presented and discussed.

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Figure Captions

Figure 1. Development as series of overlapping sets of programs

Figure 2. A general model for predicting developmental status

p. $DS = \sum[(D_p + G_f + E_e)\ A]_1 + [(D_p + G_f + E_e)\ A]_2 + \ldots[(D_p + G_f + E_e)\ A]_n$

where:

$G_f = G_i + RR + g_v - g_o$

$E_e = (P_{1,2,3,4} + S_{1,2,3,4})\ F + O + C$

and where:

DS = Developmental status

D_p = Past Developmental status

G_f = Genotype function

E_e = Effective environment

A = Aleatory factor

and where:

G_i = Genes in progress at any given time

RR = Range of reaction

g_v = Weight for those genes in a vulnerable state

g_o = Weight for those genes not now turned on

$P_{1,2,3,4}$ = Physical environment at macro, meso, micro and exosystem levels

$S_{1,2,3,4}$ = Social environment at macro, meso, micro and exosystem levels

F = Force with which the environment encounters the organism

O = Weight for state of organization of the environment at the time of the encounter

C = Weight for point in the cycle of the environment at which it encounters the organism

[ ] = Points in time when the organism or the environment undergo developmental or organizational change

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